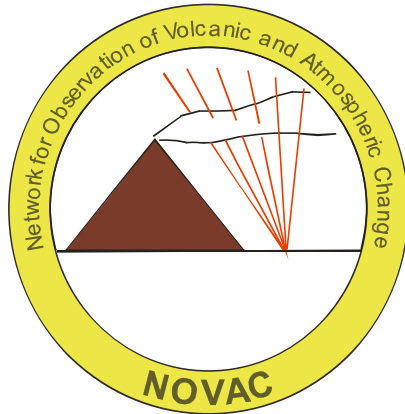


NOVAC

Network for Observation of Volcanic and Atmospheric Change



Specific Targeted Research Project:

Sub-Priority 1.1.6.3 Global Change and Eco-systems

IV.1 Natural Disasters

IV.1.2 Volcanic risk assessment

Project No: 18354

Deliverable 1.2.k

PM from the third annual meeting

2009-05-25

NOVAC THIRD ANNUAL MEETING

Mexico City, Mexico
9th – 10th November 2008



Notes taken by Patrik Norman, Chalmers

Participants:

Bo Galle	Chalmers
Patrik Norman	Chalmers
Mattias Johansson	Chalmers
Santiago Arellano	Chalmers
Claudia Rivera	Chalmers
Ulrich Platt	UHEI
Christoph Kern	UHEI
Leif Vogel	UHEI
Thor Hansteen	IFM-GEOMAR
Kristin Garofalo	IPGP
Michel Van Roozendaal	BIRA
Marie Boichu	UCAM
Nicole Bobrowski	INGV-PA
Salvatore Inguaggiato	INGV-PA
Fabio Vita	INGV-PA
Claudio Inguaggiato	UPALERMO
Silvana Hidalgo	IGEPN
Hugo Delgado	UNAM
Oscar Renteria	OVC
Cesar Morquecho	CENAPRED
Paulino Alonso	CENAPRED
Lucio Cardenas	CENAPRED
Silvia Ramos	UCHIAPAS
Gustavo Garzon	INGEOMINAS
Betty Silva	INGEOMINAS
Patricia Ponce	INGEOMINAS
Gustavo Chigna	INSIVUMEH
Francisco Montalvo	SNET
Alexander Vladimir Conde	UES
Angelica Muñoz	INETER
Julio Alvarez	INETER
Sebastian Miranda	OVSICORI
Eliecer Duarte	OVSICORI
Jose Manuel Alvarez Nieves	UNAM
Nick Varley	UCOL
Mike Burton	INGV-CA
Alessandro La Spina	INGV-CA
Simon Carn	UMBC

Preliminary agenda for the 3rd NOVAC Annual meeting

Sunday 9 November			
Auditorio "Ricardo Monges López" (Instituto de Geofísica)			
Time	Activity	Remark	Person in charge
9:00 – 9:30	Welcome, agenda of the meeting, practical details		Bo Galle and Hugo Delgado
9:30-12:00	Administrative issues		Bo Galle
	Annual Reports		
	Revised time schedule	Prolongation	
	Deliverables and milestones		
	Equipment budget status	Redistribution?	
	Installation plan		
	New Steering Committee		
	Future of NOVAC		
	Meetings	Next Annual meeting?	
12:00 – 13:00	Lunch		
13:00 – 15:00	Scientific reports by partners		Each group should prepare a 20 min. presentation of their activities during the past year
13:00 - 13:20	Overview and status of the NOVAC project		Chalmers
13:20 - 13:40	Ongoing activities in volcanic research		UHEI Christoph Kern, Leif Vogel, Ulrich Platt
13:40 – 14:00			BIRA
14:00 – 14:20	Volcanological interpretation of SO ₂ flux measurements from the NOVAC project		UCAM Marie Boichu
14:20 – 14:40			IFM-GEOMAR
14:40 – 15:00	"DOAS network at Piton de la Fournaise volcano (Reunion Island): First results from the NOVAC project".		IPGP Kristin Garofalo
15:00 – 15:30	Coffee break		
15:30 – 18:00	Scientific reports by partners		
15:30 – 15:50	Etna Update		INGV-CA Mike Burton
15:50 – 16:10	Recent SO ₂ -emission measurements at Popocatépetl and Colima volcanoes		UNAM / UCOL Hugo Delgado
16:10 – 16:30	Experience with NOVAC Scanning MiniDOAS Instruments at San Cristóbal and Masaya Volcanoes, Nicaragua		INETER
16:30 – 16:50	Performance of the DOAS Stations Located Around Turrialba Volcano during 2008. (Variation on the SO ₂ flux in the plume, according to the data collected by NOVAC instruments.)		OVSICORI Sebastián Miranda
16:50 – 17:10	Recent SO ₂ measurements at Colombian active volcanoes, using a NOVAC mobile miniDOAS system		INGEOMINAS Gustavo Garzón

17:10 – 17:30		SNET
17:30 – 17:50	Geochemistry of degassing flux of discharged fluids (SO ₂ and CO ₂) from Vulcano Island	INGV-PA Nicole Bobrowski
19:00 -	Dinner at Restaurant “La Terraza” at Mexico City downtown. Address: Avenida Madero 73	Subway Station: Zocalo

Monday 10 November		
Auditorio “Nabor Carrillo Flores” (Coordinación de la Investigación Científica)		
9:00-10:00	Scientific reports by partners	
9:00 – 9:20		UMBC
9:20 – 9:40		IGEPN
9:40 – 10:00	Instalacion y experiencias de mediciones de DOAS del proyecto NOVAC en Guatemala	INSIVUMEH
10:00 – 12:00	Special reports, Instruments Experience from installed NOVAC instruments	All partners who have NOVAC stations should give a report; Statistics (scans/day), hardware/software problems, training needs.
10:00 – 10:10	Statistical overview of archived data from the sites	Chalmers
10:10 – 10:20	Experience from installed NOVAC instruments Installation experiences at Popocatépetl and Colima volcanoes	UNAM José Manuel Álvarez
10:20 – 10:30	Maintenance of the mini_DOAS network of Colima volcano: damages and recovery of La Lumbre station	UCOL Oscar Rentería
10:30 – 10:40	Maintenance of the mini-DOAS stations of Popocatépetl volcano	CENAPRED César Morquecho
10:40 – 11:40		
11:40 – 12:00	Actions for improvement / Improvement of data flow discussion New hard- and software, modelled wind, training?	Chalmers, UHEI, BIRA
12:00 – 13:00	Lunch	
13:00 – 15:00	Special reports	Contributions are welcome. Contact Bo and Claudia, give title and duration
13:00 – 13:20	Geometrical Errors in Flux Measurements using the NOVAC Scanning DOAS instrument	Chalmers
13:20- 13:40	Radiative transfer in and around volcanic plumes	Christoph Kern
13:40 – 14:00	Geochemical evidence of the renewal of volcanic activity inferred from CO ₂ and SO ₂ fluxes: the 2007 Stromboli (Italy) eruption.	INGV-PA Salvo Inguaggiato
14:00 – 14:20	Processing different plumes at different altitudes and directions (Hugo Delgado/Lucio Cárdenas)	UNAM
14:20 – 14:40	One more year of SO ₂ and surface impact from Turrialba volcano activity. (Update from Manizales to Mexico)	OVSICORI E. Duarte, S. Miranda, E.

		Fernandez.
14:40 – 15:00		
15:00 – 15:30	Coffee break	
15:30 – 17:30	Special reports	
		Contributions are welcome. Contact Bo and Claudia, give title and duration
15:30 – 15:50		
15:50 – 16:10		
16:10 – 16:30		
16:30 – 16:50		
16:50 – 17:10		
17:10 – 17:30		
17:30 – 18:00	Closure of the meeting	
	Decisions on open administrative issues	Future of NOVAC New steering committee Next annual meeting
		All
19:00 -	Ice-breaker CCVG-IAVCEI	

09th November 2008

The meeting starts. Bo welcomes everyone to the Third Annual Meeting. Hugo Delgado representing the UNAM welcomes everyone to the meeting. All the participants then present themselves.

A preliminary agenda is presented and practicalities as lunch and the price for lunch is discussed. The basic agenda will be: first administrative issues, then scientific reports and then special reports. Dinner in the evening is on Novac and will be at the Majestic Best Western, La Terraza, from 19.30. The importance of discussing deliverables is stressed by Bo, not least because of the demands from the EU.

Administrative issues

It is now time for annual scientific reports. The reports should be 2-4 pages and it is very important to write them for the funding of the Novac project. It is also good to bear in mind when writing the report that it should be easily readable and use by others. The management report should also be written now and it be about one page consisting of the activities of the participating organisation, costs for salary, equipment, travel and so on. Convert to euros and use the rate of 1st October 2008. Also add 20% overhead to the total amount. The importance of submitting the reports is again stressed since the absence of even one of the participating organisations report could mean delay of even cancellation of the EU funding for the entire Novac project. The pre-payment is of less importance, just make sure to spend it so that we can show it to the EU. Last years reports can be used as layouts.

The Novac project will get a six months prolongation but no extra funding for that period. The commitment to the project from the participating organisations is to work on the project for one more year but now there are six months extra to work that one year.

Next report is the final report. And the final meeting will be held either November 2009 or March 2010. At the end of the annual meeting some decisions must be made:

-Final meeting(s), one or two?

-Wilfred Strauss is replaced by Anjelica Monjasin in Steering Committee. Should one more member be Gustavo Garzon?

-The future of Novac. The core is gas measurement for far risk assessment. It could be possible to get new fundings but whether that happens or not it will be necessary to discuss how to maintain the network. Funding from EU is strongly dependant on the Calls for Proposals that EU makes.

List of deliverables: (not fulfilled)

- Annual reports.
- PM from third annual meeting.
- Cost statement from third year.
- Plan for using and disseminating the knowledge.
- Report on actions taken to raise public participation and awareness.

Reports necessary from the observatories:

- Installations, including technical information, maps and photos.
- New experience that has been gained, including usefulness.
- Environmental impact studies.
- Implementation on risk assessment.

The major issues in the project right now is the meteorology, the post processing, exploitation of data for atmospheric research and the problem with scattering. All of those have deadline at the end of the project.

Work package 4:

- Update the GEIA database with Novac data.
- Global emissions of SO₂.
- Global emissions of BrO.
- Satellite correlation
(Get lists from Bo)

Economy

All instrument cost has been put together to estimate the cost of an instrument. 10% of the instrument cost has been allocated to meteorology. Wind data is today supplied by hand or looked up from the web pages of meteorological organisations. Modelling would therefore be the best complement to dual beam measurement. However there are money left and we need to discuss how to best spend them. For example it could be desirable to have two instruments on Arenal. Maybe 10 more instruments could be implemented.

Hopefully there will be three more partners in the network and maybe they will also bring some money into the project. Most important though is to keep the network coherent and analyze data in the same way, since that is beneficial for everyone.

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Scientific reports

Cristoph Kern (UHEI). *Report on volcanic research at Heidelberg*. Some of the activities have been DOAS measurements at Kilauea volcano, Hawaii, the installation of a Heidelberg instrument at Popocatepetl Volcano, Mexico, installation of 2 Heidelberg instruments and an intensive campaign at Mt. Etna, installation of one Heidelberg instrument at Piton de la Fournaise, Reunion Island.

Ongoing is also the development of a method for radiative transfer corrections that will hopefully be able to correct for some inaccuracies due to dilution and multiple scattering. An implementation of automated wind measurements with the Heidelberg instrument is under development. New geometries for mobile DOAS traverse measurements has been investigated, including multiple axis for calculating plume height. Examination of possibilities for data integration from multiple instrument types (scanning DOAS, mobile DOAS, SO₂camera...) is being done. Imaging DOAS measurements of multiple compounds is also being examined as well as a migration of the database to new hardware. An improvement of the active long path DOAS has also been made using multi-UV-LED's.

Michel van Roozendaal (BIRA). *Contribution to the spectroscopic package*. Since last annual Novac meeting 10 spectrometers have been analyzed for temperature variations and the line shapes have been found to be highly variable from spectrometer to another. The impact on SO₂ cross section is estimated to be approximately 10%. The strategy is to measure the variation in the lab and then correct for temperature variations in field by applying a temperature correction coefficient. Wavelength calibration based on Fraunhofer lines has been tested and implemented both in WinDOAS and Novac evaluation. Next step is to conclude on slit function fitting approach for implementation in the NOVAC network. For stratospheric measurements one instrument has been installed at Harestua, Norway, and data from there will be used to evaluate accuracy. If positive Novac could be NDACC associated network. So far the data has not had a very good signal to noise ratio. SO₂ data in near-real time is available via the "Support to Aviation Control Service" (SACS). From there the first unambiguous satellite identification of BrO emission from volcano was made during the Kasatochi eruption in August 2008. Total mass of emitted reactive Br in the range of 50-120 Tons. BIRAs provisional work plan for Novac is to hire NOVAC dedicated post-doc (Sofie Delanoye), explore NOVAC data base and create software tools needed to interface NOVAC data sets with BIRA retrieval and satellite comparison tools and replicate NOVAC data base at BIRA. The plan is also to extract satellite and NOVAC co-located data sets, investigate consistency of satellite data sets and improve retrievals of GOME-2 and link satellite data with NOVAC □ number of issues to be dealt with and discussed with NOVAC partners.

Marie Boichu (UCAM). *Volcanological interpretation of SO₂ flux measurements from the NOVAC project*. Methods from past studies includes signal processing of so₂ flux times series, vigilance to discriminate between volcanologic and magmatic information from atmospheric perturbations, modeling of magmatic processes to interpret observed degassing patterns, cyclicities and combining with other volcanological data. Present case studies are a time series analysis from Mt. Erebus using a flat field of view dual beam spectrometer for calculating the SO₂ flux, speed and amount. The other study is an episodic degassing model for correlating SO₂ flux with seismic activity of magmatic processes from La Soufrière de Guadeloupe. The episodic model is linked to the cooling and crystallization of magma intrusion.

Thor Hansteen (IFM-GEOMAR). *Estimating magma flux rates into the Central American Volcanic Arc using regional SO₂ fluxes from quiescently degassing volcanoes*. The conclusions are that degassing rates of single volcanoes change over several timescales so continuous measurements are needed. Not all the SO₂ reaches the surface (deep-seated partial degassing; diffuse degassing; fluid-rock interactions). Obtained flux data represent minimum values. Regional continuous degassing fluxes can be used to estimate magma flux rates into the crust. Also the sulfur fluxes in CAVA is comparable to global averages.

Kristin Garofalo (IPGP). *DOAS network at Piton de la Fournaise volcano (Reunion Island): First results from the NOVAC project*. The Novac network has been implemented on Piton de la Fournaise using one Gothenburg system with high-time resolved SO₂ measurement and one Heidelberg system with slightly lower time resolution. This enables comparison with seismic data via the Gothenburg system and it is therefore possible to study short-time events. Using the Heidelberg system with lower detection limit it is possible to make a combined study of SO₂, BrO and other species which makes it possible to investigate magmatic and atmospheric processes. The goal for monitoring gas emissions are to investigate degassing processes, volcano dynamics (processes and timescales), covariations among SO₂ degassing rate, seismicity, eruptive style and magma emission rate as well as the sulfur budget and SO₂/BrO ratio. As the first results the measured increase in seismicity and deformation in August showed numerous seismic crises but no SO₂ emissions detected during these events. However in September SO₂ degassing was associated to volcanic tremor under the summit. This indicates the presence of magma at shallow level in the volcano edifice. Preliminary evaluation indicate a SO₂ flux range of 150 -1500 T/d with more common values around 450 T/d.

Mike Burton (INGV-CA). *Etna update*. Four scanning instruments have been installed on Etna in 2007 and 2008. The objective is to compare the FLAME and the NOVAC scanners in terms of technologies, retrieved column amounts and evaluated fluxes. The FLAME scanners were installed in 2004. Also it is desirable to calculate the height of the plume by geometry using the intersection of two SO₂ maximum concentration vectors measured by two scanners. An investigation in multiple scattering by using two scanners installed along an alignment and at different altitudes. The NOVAC scanners are installed in Giarre, Vena and one each of the Heidelberg and

Gothenburg scanners in Milo. The measured fluxes from the different scanner types are highly comparable. So far the main problem has been the data transfer but that should work soon.

Hugo Delgado (UNAM). *Recent SO₂-emission measurements at Popocatepetl and Colima volcanoes.* Two new mini-DOAS networks have been implemented in Mexico, one at Popocatepetl and the other at Volcan de Fuego de Colima. At Popocatepetl there are now four scanning instruments located at Tlamacas, Chipiquixtle, Colibri and Cruz Blanca. The data is sent directly to CINAPRED. At Volcan de Fuego de Colima the instruments are located at La Lumbre and Juan Barragan. For the real time wind speed meteorological data is retrieved from radio soundings in the morning and is then changed manually when the wind conditions are observed to be different. For the post processing the wind data is gathered for every 3 hours during the day and the data is taken from meteorological archives. The best altitudes for wind data are based on observations. For Popocatepetl the average SO₂ emissions are of the order of 2000 ton/day. Those new data series, and also those at Volcan de Fuego de Colima, can be used for short term forecasting. However, better processing tools are needed.

Sebastian Miranda (OVSICORI). Performance of the DOAS stations located around Turrialba volcano during 2008. Volcanic emissions contain SO₂ which can be monitored by the Novac mini-DOAS instruments. The first four instruments were installed in April 2008. In 2007 the volcano activity increased, both seismic activity and fumaroles activity, but the SO₂ flux began to increase already in 2001 and was in January 2008 at 750 ton/day. The Novac instruments seems to be working about 50% of the time so far. The damage of the plume due to it moving randomly has been damages on the infrastructure, agricultural products and even evacuation of population. Generally it has been that the plume height increases when the flux does so. The flux has been between 26 and 3090 ton/day and the monthly average has been around 1000 ton/day.

Gustavo Garzon (INGEOMINAS). Recent SO₂ measurements at Colombian active volcanoes, using a NOVAC mobile miniDOAS system. The time averaged SO₂ flux from active Colombian volcanoes is currently approximately 7400 ton/day. Some traverses from mobileDOAS measurements were presented as well as images from the 2007 eruption at Desde. Also mobileDOAS traverses from the eruption at Nevad del Huila at 20th April 2007 were presented and there could be clearly seen a very distinct SO₂ plume.

10th November 2008

Francisco Montalvo (SNET) on installations. No presentation file.

Nicole Bobrowski (INGV-PA). Geochemistry of degassing flux of discharged fluids (SO₂ and CO₂) from Vulcano Island. Vulcano and its activity described for with emphasis on the latest 30 years. At present the activity is limited to a volcanic field, low temperature fumarolic activity and manifestations in the soil. CO₂ measurement data was presented for measurements with an IR spectrometer using an accumulation chamber. The measurements were performed during 2007 and 2008. For SO₂ flux measurements there was some coverage problems with the flat scanner but that was solved by changing to a cone scanner. Also the SD-card in the instrument needed formatting several times due to corrupt data. Internet connection for transfer of data will be available later. Different wavelength ranges have been evaluated and fluxes from a longer wavelength were found to be only slightly higher. For different polynomial degrees in the evaluation only small differences have been noted, in the morning and evening hours. Evaluation with SO₂ spectra at different temperatures, 273K and 293K, showed nearly no difference at all. The Ring effect is not important either but it is important to include the ozone fitting in the evaluation because otherwise the SO₂ fluxes will be enhanced. The SO₂ fluxes from Vulcano are of the order of 10 ton/day.

Simon Carn (UMBC) on satellites. Validation of satellite data (SO₂) using DOAS data for Okmok Kasatochi.

Silvana Hidalgo (IGEPN) on results and statistics for SO₂-measurments at Tungurahua. Degassing and seismicity, how much gas is emitted explosively?

Gustavo Chigna (INSIVUMEH). Instalacion y experiencias de mediciones de DOAS del proyecto NOVAC en Guatemala

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Special reports

Mattias Johansson (CHALMERS). Statistical overview of archived data from the sites with a sincere request to increase uptime for instruments that have not gathered so much data.

Angelica Muñoz (INETER). Experience with NOVAC. Scanning MiniDOAS Instruments at San Cristóbal and Masaya Volcanoes, Nicaragua. A short resume on the setup and working of Novac instruments at San Cristóbal and Masaya.

Betty Silva (INGEOMINAS) on installation on Galeras, Colombia. Emphasis on the choice of installation locations, communication with instruments, technical difficulties during installations and statistics on the working of the three Novac instruments.

Mattias Johansson (CHALMERS). Geometrical Errors in Flux Measurements using the NOVAC Scanning DOAS instrument. On errors due to sampling, tilt of instrument, flux algorithm and changing plume during measurement.

Cristoph Kern (UHEI). Radiative transfer in and around volcanic plumes. On creating a radiative transfer model to use with the Novac instruments for correction of scattering, aerosols etc.

Salvo Inguaggiato (INGV-PA). Geochemical evidence of the renewal of volcanic activity inferred from CO₂ and SO₂ fluxes: the 2007 Stromboli (Italy) eruption.

Hugo Delgado (UNAM). Processing different plumes at different altitudes and directions. On the Novac network on Popocatepetl and Volcan de Fuego de Colima. SO₂ emissions and short term forecasting.

Mattias Johansson (CHALMERS) on the recent improvements in the Novac software. These are including support for new Axis electronics, composition measurement mode, calculation of wind direction and plume height, reading of wind fields and interface improvements.

Discussion

Several topics came up during the discussions and they are:

- Change of electronic box for the instruments might (probably) solve many problems since that is the most sensitive part. The new electronic box is produced by Axis and has been tested at Chalmers with good results. It is however necessary to learn new commands for communicating with the new electronic box.
- Communication with the instruments via the radio is also sensitive but works well with Freewave radio modems. Careful installations are necessary to avoid later problems. Maintenance has to be regular in order to keep the communication working.
- There is a suggestion from Bo Galle that observatories running the Novac software to gather information from the instruments have to submit a protocol monthly to report the status of each instrument and observatory.
- All partners need to review replacement and spare parts in order to distribute these for maximum data acquisition.
- There is a need to redistribute funding in order to achieve at least two working instruments per partner. Bo Galle and Ulrich Platt will take care of that.
- EU can charge the consortium for goals that has not been fulfilled so it is extremely important to make sure to fulfil these goals.

- Training of the participating partners is necessary. Is it possible to arrange a workshop? No definitive answer yet.
- When shall we have the next annual meeting? Will there be one or two more meetings? The Novac project will finish 1st of April 2010. Gustavo Garzon suggests having the meeting in Antigua, Guatemala.
- What is the future of Novac? Suggestions are very welcome. Supply ideas of new points of view for usage and development of Novac. We should for example develop techniques further and expand the network. Exploiting the data already collected is also crucial.